Red Guides
Paper 37

Effective use of PowerPoint in a lecture environment

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Red Guides address educational and staff development issues within Higher Education and are aimed at colleagues within the University and at other institutions. Some describe current good practice in Higher education, others evaluate and/or comment on curriculum development and many provide ideas for teaching. All are meant to stimulate discussion, initiate action and implement change.

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Context

There is now widespread use of presentation software, such as PowerPoint, in United Kingdom higher education. The extent of this presentation revolution is that PowerPoint has now almost totally replaced the overhead projector as the presentation medium of choice for lecturers and, in addition, largely supplanted whiteboard and blackboard. In addition, there is the greater potential for using presentation software as part of a distance learning material and it is easy to see why it is becoming the de facto standard for lectures.

While there is a wide variety of guidance material available for somebody planning to make a presentation, there is only a limited amount of information available for the particular requirements of using presentation software in a lecture environment. Indeed, the starting point for this guide was through personal reflection on using presentation software and seeking (what turned out to be limited) further information to improve personal practice. It is also fair to say that many of the ideas in this guide are from discussion of these issues with colleagues, for whom I am grateful for their thoughts, advice and encouragement.

Choice of presentation software

The lecturer wishing to use electronic presentation software as an integral part of the lecture has a good choice of suitable packages. In practice however, the choice will be limited to that provided by the educational institution, although it is prudent to be aware of the options. Typical packages include:

- PowerPoint: In terms of prevalence it is possible to see this package as the industry standard. Forming part of Microsoft's 'Office' suite of productivity packages, it has the advantages of being cross platform, supported by PC and Mac operating systems. This is the only software endorsed by Northumbria University and is therefore the only choice that has technical support within the University.
- Keynote: Single platform presentation software designed solely for use in the Mac operating system. Being single platform and not part of an integrated suite, it is not trying to be all things to all people, with advantages in terms of stability. Proponents point to the greater intuitive ease of use associated with Apple software, and the package is therefore arguably superior to PowerPoint. However, despite this, being single platform on an alternative operating system restricts availability.
- Impress: This is a cross platform, open source, equivalent to PowerPoint and within an equivalent to the 'Office' suite. Developed by enthusiasts within an open source environment, this package has the major advantage of not costing anything to acquire other then the time to download. However, as an enthusiast project, it is potentially 'buggy' compared with commercial software. Furthermore, it may not have all features one would expect from commercial software.

Structuring this guide around PowerPoint merely reflects the fact that this particular presentation software package is the industry and Northumbria University standard. The principles discussed are equally applicable to the aforementioned presentation

software. In recognition, the slides used as an example in this guide were created using PowerPoint, although were also assessed using Keynote.

Educational issues with using PowerPoint

While subject to criticism, the lecture continues to remain an essential tool in higher education teaching practice. Indeed, with lectures based upon ancient oratory it is arguably the most enduring form of mass communication. However, what are changing are expectations from a lecture in a 'multimedia age'. Therefore, in reviewing the use of PowerPoint in a lecture context, it might be best to summarize what we expect from an effective lecture, with a suggested list of the main expectations for an effective lecture including:

- Information delivery, along with retention of information by note taking. The essential core of a lecture is that the lecturer, presumably an expert in the subject of the lecture, has information that they need to impart to the students.
- Validation of understanding. Although viewed as a 'one way' method of communication, ideally the lecturer will include validation as an integral part of the lecture, either formally by inviting questions or by the lecturer modifying delivery through awareness of student response.
- Demonstration of techniques. The demonstration of a skill, process or technique can bring theory to life, or indeed create the framework to discuss theory. The spoken word cannot always convey the detail required and a demonstration is of use to enhance the understanding and learning process.

Furthermore, the very act of demonstration can inspire, which is the final expectation for a lecture.

- Creating enthusiasm. This is perhaps the most intangible and yet arguably the most vital aspect of a lecture. It is possible to deliver the information in a lecture, be it by spoken word or demonstration, and validate this delivery, without engaging the enthusiasm of the students. The difference between a competent and a fully effective lecture must surely be the degree of student enthusiasm for the subject as they leave the lecture.

Lowry (1999), in discussing early experiments in the use of PowerPoint in a lecture environment, comments upon the paradox that a lecture represents. In essence, although some people describe a lecture as inefficient in engaging with academic knowledge, nevertheless Lowry goes on to comment that for all practical purposes it is efficient because of the opportunity provided to simultaneously expose a lot of information to a very large number of students. However, Lowry identifies that one reason why this information transfer is not as effective as it could be through students suffering from attention breaks, suggesting that an electronic presentation of lectures could be a suitable device to prevent these breaks and led to improved learning.

In a normalised test over two consecutive years, Lowry compared results where in the second year the lecture delivery was by PowerPoint. Allowing for variable factors such as successive cohort being of equal academic ability, Lowry concluded that the PowerPoint presentation could be a partial solution in preventing the attention breaks that limit lecture effectiveness.

However, Lowry notes that, at the time, lecture delivery using PowerPoint was relatively rare and there is a suggestion that the novelty value of the PowerPoint presentation may distort the results. Furthermore, there is the undefined but real aspect relating to the impact of the “lecturer’s style and enthusiasm”.

In a similar study to compare results following introduction of PowerPoint lecture delivery, Ahmed (1998) concluded that assessment results showed very little difference. In discussion, suggested factors included students distracted by added visual images. Ahmed concludes that using PowerPoint is a not perfect solution and that knowledgeable, enthusiastic instruction remains the most important thing in teaching.

Bartsch and Cobern (2003) in two studies investigated whether students liked and learned from PowerPoint presentations. They confirm the findings that PowerPoint does not have any noticeable effect on student marks, even though the students in the study preferred the PowerPoint presentations and, perhaps most tellingly, perceived that they learn more from the PowerPoint lectures. Bartsch and Cobern went on to analyse how the content of a PowerPoint lecture affects performance. In their discussion, they note how unrelated graphics in a presentation has a negative effect on the learning of the material. With regard to related graphics, they comment that there are neither beneficial nor harmful to the learning of the material and were unnecessary to motivate a student to be interested in the material.

Looking in detail at the issue of pictures, Bartsch and Cobern (2003) identify a difference in how effective the

pictures are according to the spatial ability of the student group, concluding that students with high spatial ability appear to do better when presented with text and images as compared to just text. In comparison, they found no demonstrable difference for students with low spatial ability. A further factor here is that graphics are of use where the material is more complicated or the students do not have a great deal of prior knowledge of the material. This particularly applies to problem solving tasks. Paradoxically, inclusion of graphics, particularly irrelevant items, increases the time taken to prepare a PowerPoint lecture over a normal lecture, although Bartsch and Cobern conclude that as it is possible to reuse the lecture many lecturers would consider this acceptable. Nevertheless, they conclude that while related graphics may be useful, unrelated graphics are not helpful for enjoyment or learning. Therefore, for simple declarative information, graphics are not necessary. However, graphics may help with more difficult, complex, or abstract concepts presented during the lecture.

Anderson (2004) comments that the advantages of PowerPoint are difficult to transfer to the classroom and, in evidence, cites the reaction of colleagues who describe PowerPoint as taking life out of a class. In investigating these comments, Anderson notes that the fundamental problem is electronic slides script a lecture and without providing a mechanisms to adapt the presentation to the audience response. The solution is not inherent in PowerPoint, but discussed in the emerging technology of tablet PC's where, in a similar manner to the overhead projectors now rendered largely obsolete by PowerPoint, the lecturer is able to write to a screen on a prepared template.

Is PowerPoint an appropriate medium?

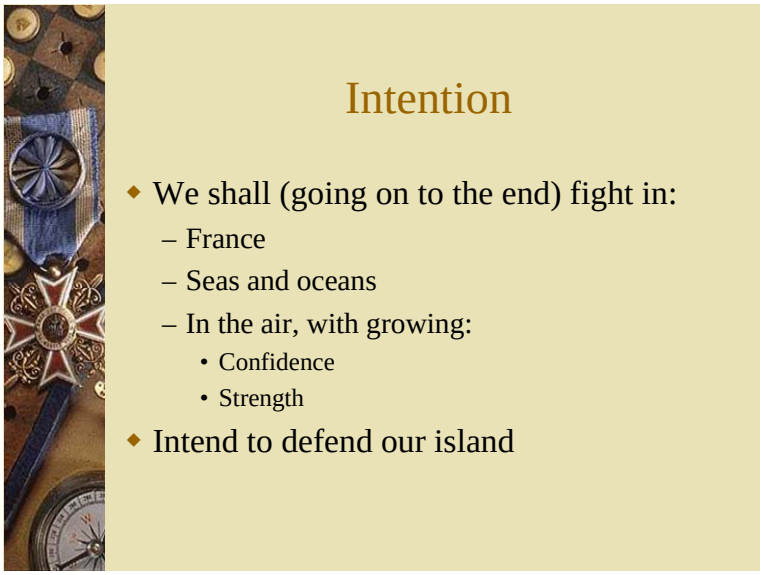
The research comments are telling. In simple terms, it would appear that PowerPoint will not make somebody an effective presenter, and furthermore, an effective presenter does not require PowerPoint. Consider the following inspired oratory:

> "We shall go on to the end, we shall fight in France, we shall fight on the seas and oceans, we shall fight with growing confidence and growing strength in the air, we shall defend our Island, whatever the cost may be, we shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender…" (Churchill, 1940.)

(This example inspired by the 'Gettysburg PowerPoint Presentation', a satire attributed to Peter Norvig, Director of Research at Google)

And now as a PowerPoint presentation:

Slide 1



Slide 2

While adequately expressing the facts, it seems unlikely that the PowerPoint version would inspire a nation. Moreover, is it fair to expect the PowerPoint presentation to do so? In considering which has the greater impact, clearly it is prudent to consider the intended message and be aware of the weaknesses in using PowerPoint.

‘Death by PowerPoint’, criticism of presentation software

PowerPoint is subject to criticism as an ineffectual communication tool. The root cause appears to be a belief that using PowerPoint will automatically turn a bland featureless subject of presentation into

something interesting. Generically, this approach, often styled ‘Death by PowerPoint’, is characterised by an unimaginative approach to using PowerPoint coupled with an excessive use of the readily available formatting that comes with PowerPoint.

What actually constitutes ‘Death by PowerPoint’ varies according to who is writing on the subject. However, typical examples include:

- Too many words on a slide, particularly where it crowds the text and forces fonts to become too small to read easily on the projection screen.
- A presentation that simply involves reading of each slide.
- Using over fussy templates and every available gimmick, particularly with respect to transitions. Corbin Ball (2002) describes how it is possible to identify new PowerPoint users by their indiscriminate use of slide transitions and sound effects.
- Slow visual effects (for example, text appearing one letter at a time).

Tufte (2005) formalised these criticisms in an analysis of the decision making process that lead to the loss of the Columbia space shuttle in 2003. Tufte’s criticism centre on the following slide, prepared to review the damage observed on take off and while Columbia was still flying:

Slide 3

Review of Test Data Indicates Conservatism for Tile Penetration

- **The existing SOFI on the tile test data used to create Crater was reviewed along with STS-87 Southwest Research data**
  - **Crater overpredicted penetration of tile coating significantly**
    - **Initial penetration to described by normal velocity**
      - Varies with volume/mass of projectile (e.g. 200ft/sec for 3cu. in)
    - **Significant energy is required for the softer SOFI particle to penetrate the relatively hard tile coating**
      - Test results do show that it is possible at sufficient mass and velocity
    - **Conversely, once tile is penetrated SOFI can cause significant damage**
      - Minor variations in total energy (above penetration level) can cause significant tile damage
  - **Flight condition is significantly outside test database**
    - **Volume of ramp is 1920cu in vs 3 cu in for test**

Tufte observes that with a multilevel of bullets the presentation obscures the message of ‘significant’ risk. The conclusion is that rigid slide-by-slide hierarchies are indifferent to content, producing an anti-narrative with choppy continuity through slicing evidence into arbitrary compartments. In comparison, Tufte comments that email written by lower level NASA engineers using simple paragraph structures and limited bullet points provided a clearer indication of the potential danger to Columbia.

Clearly the more over-complicated one makes a PowerPoint presentation the more it obscures the content and thus hinders effective communication. As a demonstration, do not do this:

Slide 4

While perhaps appropriate for a notice, this background is too fussy and represents a distraction for an on-screen display. The ‘clip-art’ graphic is generic, thereby irrelevant and provides a further distraction from the message. The text font size is too small for easy reading from the screen (and will take for ever if it appears one letter at a time), although clearly the inclusion of everything means that the lecturer will simply read this verbatim, with limited discussion and explanation. Overall, this slide will distract from any learning process, plus reading from the screen will limit the students engaging with the subject in any meaningful manner and limit the lecturer expressing their individuality or enthusiasm for the subject. Perhaps the only redeeming quality is a reasonably high contrast between the text and background.

Generally, the advice to avoid ‘death by PowerPoint’ includes:

- Limit the number of words on a slide. Often suggested is a limit of 15 words and structure the slides for impact rather then give the effect of reading a report.
- Make careful use of transitions, taking care that if using an effect it does not distract but rather helps the audience know where you are heading.
- Take great care in choice of design templates, selecting those without busy backgrounds. Aim for contrast.
- Follow the classic lecture advice of ‘tell them what you are going to say, tell them, tell them what you have said’. Set an agenda and summarise.
- Have passion in your topic.

The last point is, once again, an overriding theme. In the same way to the conventional lecture, with PowerPoint it may be that a poor presentation does not necessarily lie with the presentation, but with the presenter. In other words, PowerPoint will not rescue a poorly prepared and uninspiring lecturer.

Effective use of PowerPoint in a lecture environment

To summarize, the advantages in using PowerPoint in a lecture environment are:

- Using PowerPoint creates a structure in planning and presenting the lecture.
- Ability to present multimedia in one package;

    - Text (previously overhead projector)
    - Charts (previously overhead projector)
    - Images (slide projector and screen)
    - Video (television and video player)
    - Web sites (no real previous application)
- PowerPoint templates ease (or constrain) the task of creating a professional presentation.

Conversely the disadvantages are:

- Presentations may appear impersonal.
- The constraint of a PowerPoint slide may be inappropriate or too difficult for some teaching content, such as calculations.
- There is a tendency to focus on the presentation and not the lecture purpose.
- Constraint as to lecture structure (as opposed to overhead transparencies, where it is possible to rearrange or skip transparencies according to circumstances).

It is perhaps self evident, and yet vital to stress, that the design of a PowerPoint presentation must focus on the purpose of the lecture. Specific points that may be of use in preparing a PowerPoint lecture are:

- The biggest mistake is to have all notes on slides (especially if also giving slides as a handout) as it encourages no note taking and little interaction.
- Apply the KISS (Keep it Short and Simple) principle to each slide.

- With the time taken to prepare a PowerPoint lecture, it may be worth keeping the information generic, especially for fast changing subjects, and discussing current or location specific detail in the lecture.
- Plan the use of multimedia in terms of the learning environment and lecture objectives.

The issue of handouts is important. Handouts are an integral part of a modern lecture in higher education, and the standard procedure is to provide a copy of each PowerPoint slide (following the previous model of providing a copy of each overhead transparency). While perfectly adequate, an optimum solution is to provide a handout in the form of a workbook providing detailed information with the lecture giving the framework. This removes the temptation to include superfluous detail in the PowerPoint slides, as the lecturer is aware that the information will form part of the lecture and appears in the workbook. However, in terms of time available to a busy lecturer, a workbook is additional time over and above the time required to prepare a PowerPoint lecture.

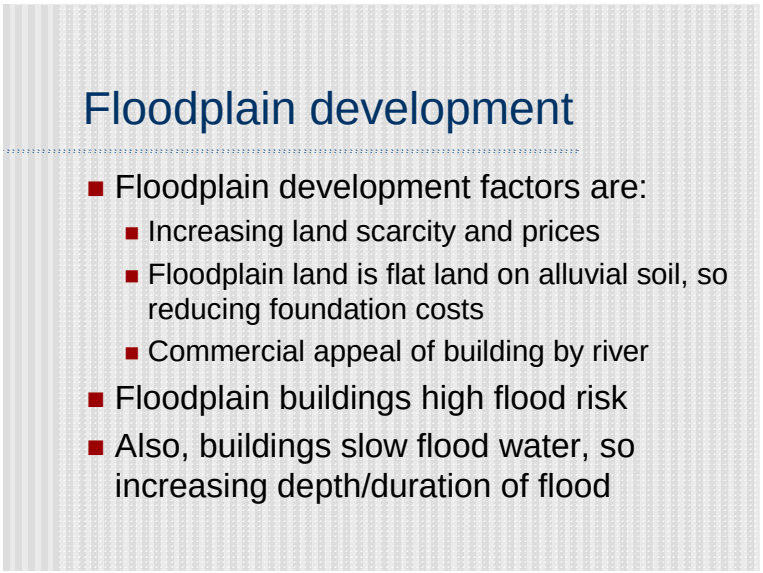
Suggested formats

At the outset, it is important to stress that there is no intention to set a prescriptive format for a PowerPoint presentation. Each lecturer has a different style of preparation and delivery, and each student group has difference demands, potential and limitations. Rather, the following are a series of slides along with a discussion of the merits and difficulties with each slide type. What is important is that the discussion in each case is against the criteria examined so far as to what

constitutes an effective PowerPoint presentation in terms of imparting information and motivating students.

Possibly the most common type of slide is where presentation of the subject is by a series of simple statements:

Slide 5

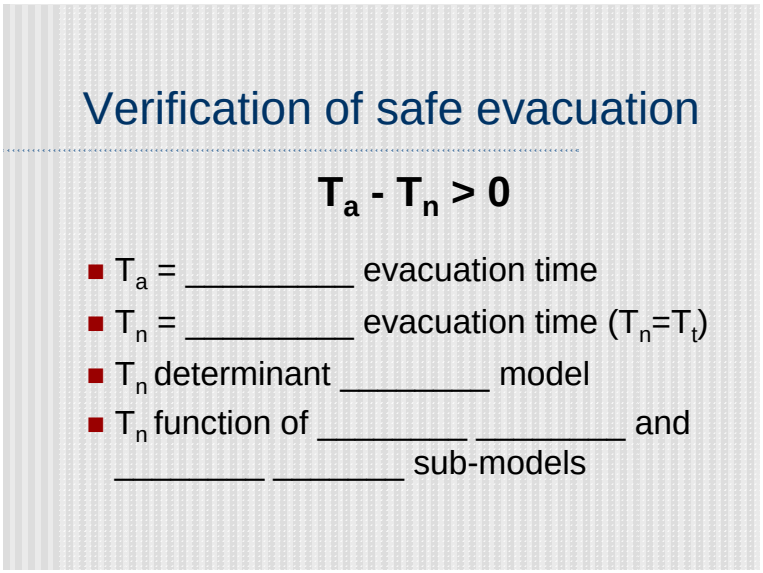


It is important to note that this slide, and all that follow, makes use of a plain unfussy background, allowing the students to concentrate on the message, not the medium. Furthermore, the font is deliberately chosen to be clear and of a size easy to read from the screen.

To address the issue of limited student engagement, especially where the slides form the handout, it is possible to employ the gapped presentation method. By

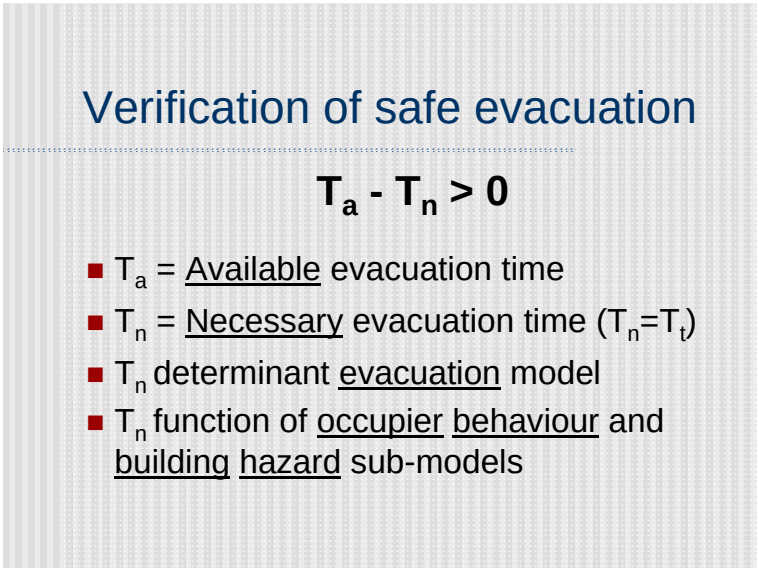
omitting key words from the handout and progressively introducing them on screen, prompts the student into a rudimentary form of note taking:

Slide 6



And with the presentation filling the gaps:

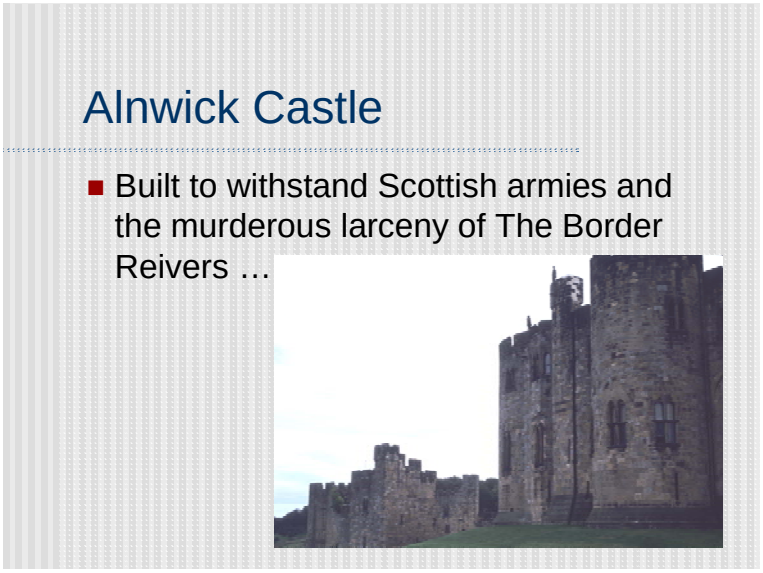
Slide 7



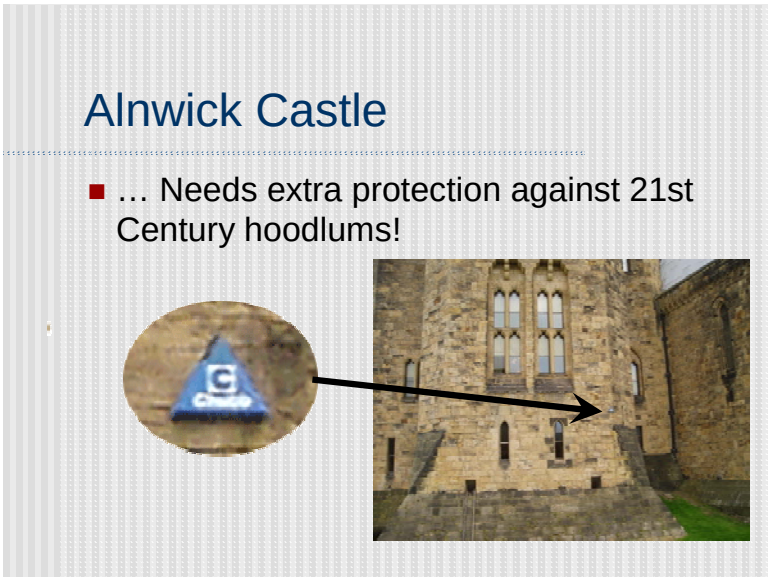
Certainly, this has the effect of prompting attendance, attention and some form of note taking by the students. However, their engagement is limited to copying from the screen and they then perceive that they do not need to take any further notes as the lecturer goes onto explain the theory and practice of each statement. While forcing into some note taking is apparently tempting, the limited engagement inherent in this type of approach means it is necessary to use with caution and perhaps best reserved for lectures introducing a subject. Even then, it may give a message that this is all that required in the form of note taking and may be of detriment later on in the subject where more detailed information makes this method clumsy and requires careful note taking.

One possible exception to the problems with the simple statement type of slide is where there is an expectation for the students to simply read the slide. Typically, this will be a visual interlude in a lecture, usually as part of the break that most lecturers will programme into a lecture to change pace and help concentration. The following example, from a lecture on intruder detection, applies:

Slide 8



Slide 9

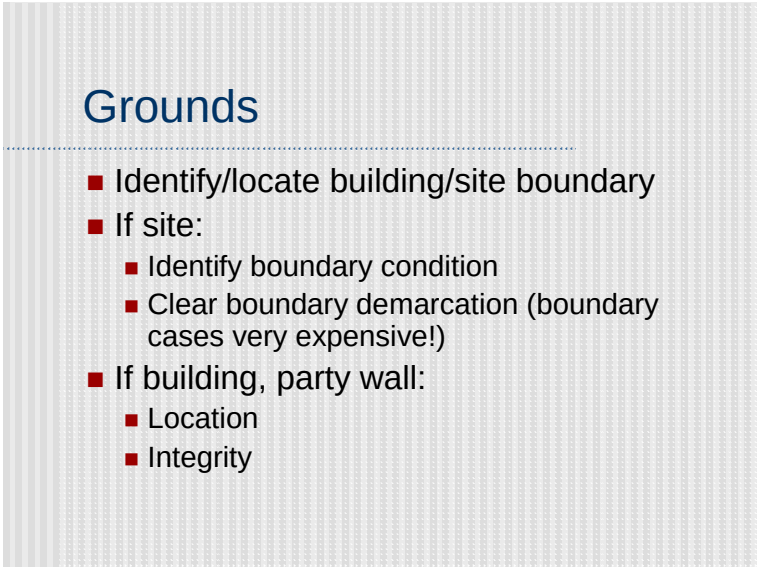


As can be seen, the first slide needs no introduction. Similarly, the second slide can follow on in the same way when the lecturer perceives that the group has read and assimilated the first slide. As this can be done wordlessly, so it is acceptable, possibly, to have a more complicated transition, such as a dissolve, between the slides to emphasize that a change is occurring.

A problem with each slide so far is that they do not conform to the principle of limiting the number of words for each slide. With the exception of the clumsy process prompted by the gapped slide, there is a real danger that the information provided might encourage minimal note taking by most students. The solution is to apply

the KISS principle and reduce the information to key words as in this example:

Slide 10



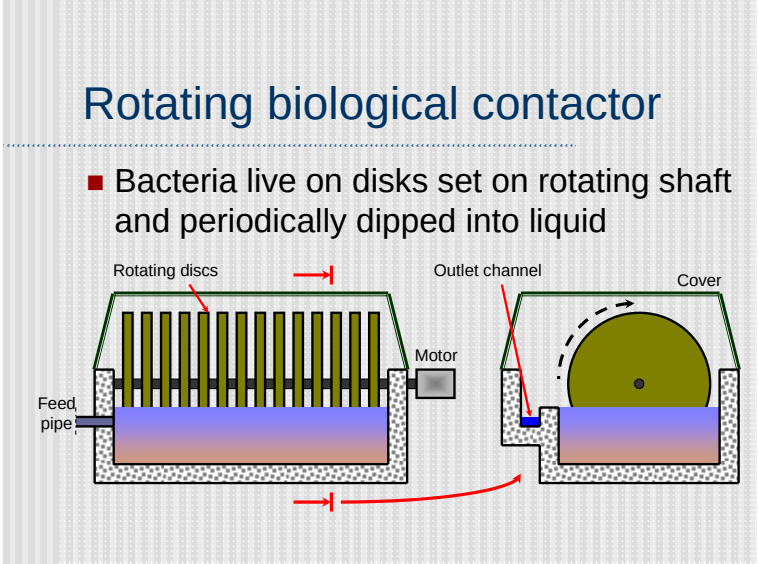
With the slide setting an agenda, there is minimal to read and should prompt most students to take appropriate notes. A further advantage is that, while nothing can effectively overcome the lack of running order flexibility inherent in PowerPoint, use of key words only allows the lecturer flexibility in dealing with each slide. Thus, the lecturer can be aware of the student mood and immediately address issues where the material requires amplification or validation.

By prompting for note taking, arguably this type of presentation will not require any form of handout. However, while possibly fine for some types of theory,

this will generally not apply where diagrams and illustrations are an integral part of the material. The ideal will be a handout in the form of illustrated notes covering the lecture without merely duplicating the slides. This is an optimum, although constraints of time may make it more desirable then realisable.

As discussed earlier, the use of relevant illustrations (or other multimedia) enhances the learning process in PowerPoint. Once again, the KISS principle would seem to apply:

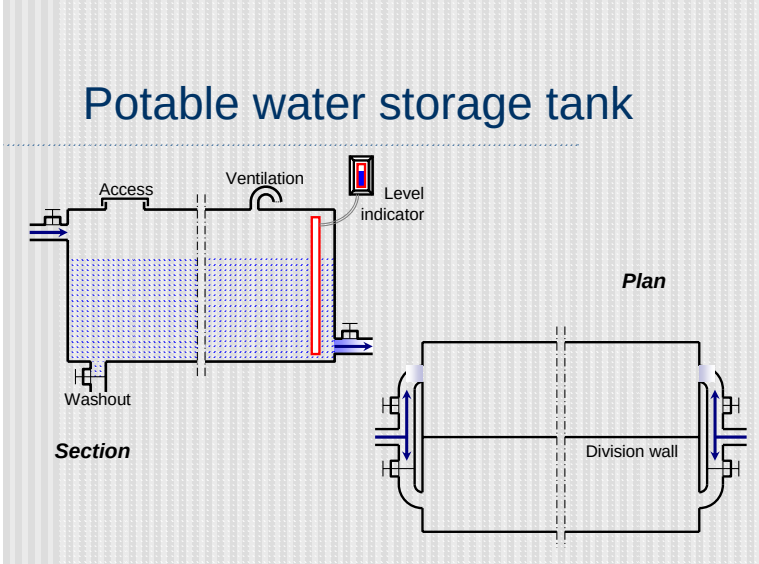
Slide 11



Clearly, the diagram is a simplification to show the main points of the technology. The simplicity enhances clarity on the screen and will need more detail in a handout or reference in further reading to a more detailed

illustration. The value of the text is questionable. It is insufficient to convey any meaningful information and as such appears superfluous. Omitting the text and discussing the main points, perhaps amplified in the handout, would seem to be a better option, as in the following slide:

Slide 12



Here the focus is entirely on the illustration (although with some key annotation). The lecturer has flexibility to discuss all aspects without constraint of trying to follow specific text. Furthermore, the illustration allows introduction to more detailed information in any handout.

These same principles apply to any other type of media presented through PowerPoint. Therefore, for example,

it is possible to see the same issue of whether to include text when using photographs here:

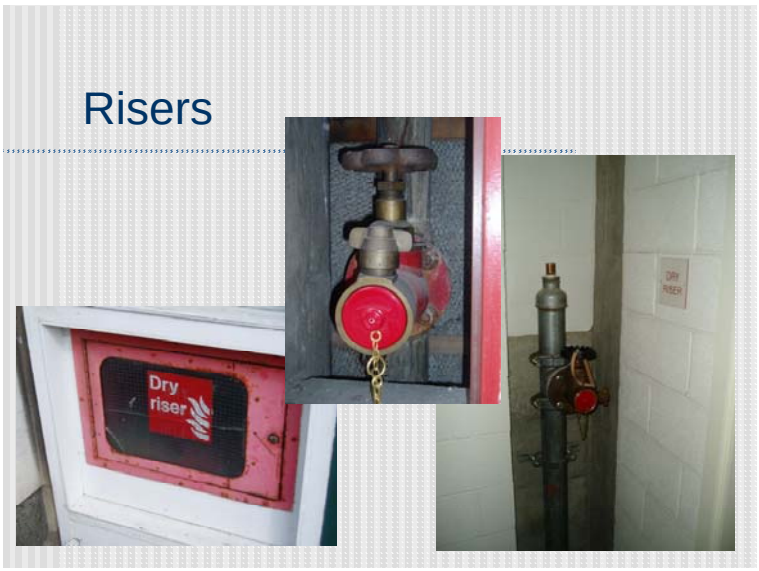
Slide 13

Surface water abstraction

- Abstraction through inlet from water course
- Screen collects rubbish
- Usual settling chamber behind screen, reduce scour at high flows

And here:

Slide 14



Once again, the text appears superfluous and most presentation impact, along with flexibility, is possible by solely using the photographs.

An exception to the rules appears to be mathematics, particularly where the group are hesitant in the subject (such as where mathematics is a subsidiary part of the course). In these circumstances, practice indicates that the most efficient way of engaging the students and, crucially, ensuring comprehension, is to work through solutions in ‘real time’. Typically, this will be by way of a workbook and board, with PowerPoint limited to setting the scenario:

Slide 15

Steel beam design

A 4.00m wide opening in a 150mm thick internal load bearing wall is required for a major alteration scheme. This opening, being subject to a uniformly distributed load of 12 kN/m (including beam self weight) together with a central point load of 40 kN, needs a steel beam to support the structure above. Assume a simply supported beam in Grade 43 steel, allow a permissible stress of 165 N/mm^2 and a modulus of elasticity of 205,000 N/mm. Sketch the shear force and bending moment diagrams, indicating the principal values and positions. Calculate a suitable beam size for the loading situation under bending, checking for shear and deflection.

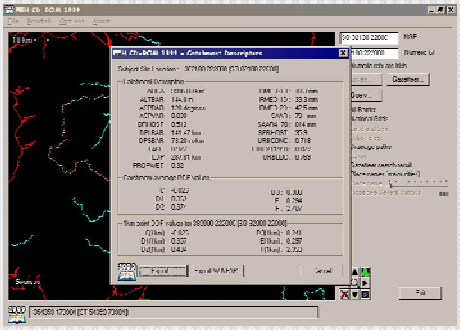
With the problem set, the lecturer will use a writing medium (whiteboard, blackboard or tablet PC) to demonstrate the calculation. The problem remains on the screen during the calculation process as a reference.

Another specific issue relates to demonstration of material in a computer package or from a web site. As much as it may be tempting to try this in ‘real time’, in practice this is hostage to the software performing as expected or the web site being available as expected. To avoid the unsettling unexpected in a lecture, it is usually better to present this type of material as a screen shot ‘prepared earlier’:

Slide 16

Catchment data

- Query relating to selected catchment



This screen shot is part of a series showing a specific data generation process. The source software needs loading onto a host computer and would be too ungainly to execute in ‘real time’, so the screen shot effectively demonstrates the principles.

Conclusion

The first question a lecturer needs to ask when considering the use of PowerPoint in a lecture is if it is the most appropriate presentation medium for the proposed lecture. It may be that the content will not fit easily into a PowerPoint format, and that to use PowerPoint will hinder the learning process.

Should PowerPoint be appropriate, generally the advice given earlier about how to avoid ‘death by PowerPoint’ applies. To summarise:

- Set an agenda and summarise.
- Limit the number of words on a slide.
- Keep information generic.
- Make careful, limited, use of transitions.
- Carefully chose a design template with contrast.
- Only use relevant graphics.

Above all, it is vital to have a passion in your subject.

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